kinds of microbes are present in water, whilst on a closer examination the list of varieties is very much more extended. Having regard to their superficial differences, then, Lustig, following the example set by Eisenberg in his "Bakteriologische Diagnostik," has mapped out two classes of microbes—those which liquefy and those which do not liquefy the gelatine—which are again divided up into micrococci and bacilli respectively. The tabulated account appended to each micro-organism includes its microscopic appearance, behaviour in gelatine-plate and tube-cultures, on agar-agar and potatoes, relationship to pathogenic properties, temperature, together with other special tests which have from time to time been employed, as well as the authority for its discovery in water.

In addition to the above classification, those bacteria which are known to be pathogenic to man and animals respectively are separately grouped, whilst those bacilli resembling the typhoid bacillus are brought together for purposes of comparison. The latter should prove a useful assistance in the separate diagnosis of the typhoid bacillus, for as it is by no means specially characteristic either in its macroscopic or microscopic appearances, there are many forms which may readily be mistaken for it on an ordinary water-plate.

We do not quite understand why Lustig has not rendered the cholera spirillum a similar service. There exist many spirilla in water which bear the most striking resemblance to Koch's comma spirillum, but which subsequent searching tests have proved to be distinct. Koch himself only a few weeks ago stated that no less than a dozen different vibrios had been isolated in his laboratory alone, from various waters which he examined last autumn during the cholera epidemic, none of which were the cholera spirillum, whilst other investigators have identified and described spirilla bearing the closest resemblance to the original comma spirillum.

Amongst the organisms pathogenic to man found in water we miss the tetanus bacillus. This organism was detected by Miquel in the rivers Seine snd Marne, and G. Roux states that he found it in large numbers in the sediment of the filter beds belonging to the water-works supplying Lyon with river Rhône water, whilst Lortet alleges that he discovered it in mud obtained from the bottom of the Dead Sea. In a future edition the anthrax bacillus must also be included, since it has recently been detected in the sediment at the bottom of a well, to the water of which an outbreak of anthrax amongst a flock of sheep was traced.

In the preface to the German edition Baumgarten writes: "Grössere Reihen von 'Wasserbakterien' sind schon früher von anderen Forschern (Frankland, Maschek, Adametz, W. Zimmermann, Tils) auf Grund eigener Beobachtungen und Untersuchungen beschrieben worden. Diese sowie *alle sonstigen*, verstreut in der Literatur . . . ist Lustig's Verdienst vereinigt zu haben." It is obvious that in a guide of this kind the list should be as complete as possible, and it is, therefore, surprising to find many important and quite unaccountable omissions. For example, none of the interesting phosphorescent bacilli obtained from sea-water by Forster, Fischer, and Katz are described, neither is any mention made of the organisms isolated by Russell from sea-water.

Amongst other organisms conspicuous by their absence may be mentioned the *bacillus thermophilus* originally found in large numbers in river Seine water by Miquel, the anærobic bacillus, *B. amylozyme* obtained by Perdrix from the same water, the *bacille rouge de Kiel* so carefully studied by Laurent, the "peach-coloured bacterium" of Lankester, whilst Roscoe and Lunt's sewage organisms, and Tataroff's large collection of bacteria isolated from the Dorpat water are entirely overlooked.

The descriptions appended are often provokingly incomplete, and this greatly militates against the value of the book in assisting in the identification of a particular organism, whilst in some cases the details are not always correct.

The book was originally written in Italian, so possibly during the translation into German errors and misprints may have crept in which were not present in the original, but it is none the less troublesome to find wrong references occasionally given, whilst the description of the same organism twice over, which occurs more than once, ought surely to have been guarded against. As an example of this we may mention a bacillus found by Claessen (mis-spelt Claesten) in unfiltered river Spree water, and described on p. 62 as the *Indigoblauer bacillus*, whilst on p. 70 we find it figuring again as bacillus, *Berolinensis indicus!*

In order to bring the descriptions up to a level with those in Eisenberg's "Bakteriologische Diagnostik," even (and as the volume before us deals solely with water-microbes, they might not unreasonably be expected to be fuller) careful revision will be required, and the evident signs of haste which at present characterise its pages conscientiously removed.

Such an array of different water microbes, to each of which is given a "local habitation and a name," might well make the reader say with the "Ancient Mariner," "Water, water, everywhere, Nor any drop to drink;" but it is reassuring to find that out of the 181 varieties found in water, only six are stated by Lustig to be pathogenic to man.

P. FRANKLAND.

POPULAR METEOROLOGY.

Katechismus der Meteorologie. Dritte Auflage, gänzlich umgearbeitet. Von Prof. Dr. W. J. Van Bebber. (Leipzig: J. J. Weber, 1893.)

THE object of the author of this little book is to present as briefly and intelligently as possible the fundamental principles of meteorology, in a manner which will enable the public to form for themselves an independent judgment on the meteorological conditions prevalent at the moment, and to make the knowledge so obtained available for the purposes of daily life. The author, who is well and favourably known as a popular writer on meteorology by his *Lehrbuch*, thinks that this eminently practical object can be best effected by placing his information in a catechetical form; a method of conveying instruction which appears to find great favour in Germany. This particular work is already in its third edition, and is the sixtieth of a series which in its entirety probably comprises more than twice that number of works devoted to the culture of science, art, and indus-

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try, and all forming part of the "Illustrierte Katechismen." This form, however, is not one that commends itself generally to the writers of English text-books, at least in modern times. It is believed that the fascinating style of the ingenious Miss Mangnall endeared her writings to an earlier generation, but the peculiar form of which she was so admirable an exponent has not found many imitators. But the case seems to be different in Germany, to judge by the number of works and editions in this catechetical series, to which we have referred. The author contends that the form of the work is suitable, and in his recent revision he has preferred to retain it. But if the questions in a slightly altered shape were made to fill the place of marginal notes, and the information were presented in a continuous readable form, it would, to an English eye at least, be preferable to that adopted, which has all the appearance of a collection of conundrums without their interest. But apart from this question of form, there are two reasons why we are inclined to dissent from the judgment of the author. Meteorology has hardly crystallised into that definite shape in which a cut and dry answer can be given to every definite question. The author seems to take some praise to himself that every hypothesis has been most carefully excluded. But this is a very doubtful merit. It has the immediate effect of excluding much that gives a charm and interest to the study, and without a knowledge of which one can hardly be said to be instructed in meteorology. Working hypotheses, recognised as such, have a distinct value, especially in a science where much is, of necessity, tentative and experimental. The other objection which might be urged against the style arises from the fact that, in the present instance at least, it does not lend itself readily to the description of diagrams. Perhaps this explains why the book is not more profusely illustrated. It was doubtless felt that diagrams did not greatly add to the clearness of description.

The contents of the book are generally such as one would expect to meet in an elementary work on meteorology. There are, however, some exceptions, in which the author enters upon subjects which we are apt in this country to include under the wider title of physiography. After dealing with the temperature of the atmosphere, its daily and annual variations, the peculiarities of isotherms, &c., we have an account of barometric records and variations of atmospheric pressure with theories of the wind. Under this heading are treated such subjects as land and sea breezes, local winds, such as monsoons, and movements of the atmosphere affecting small areas. The transition to such subjects as the Gulf Stream and ocean currents is easy if a little unexpected, but the author soon returns to topics more immediately connected with meteorology properly so called. The subject of evaporation, and the deposition of moisture in its various forms, is sufficiently dealt with, and if there is nothing new in this chapter it is clear and satisfactory, and the same can be said for the few concluding questions on electrical and optical phenomena. A few remarks might have been added with advantage on the aurora, but possibly the author was afraid of hypotheses.

The most readable and the most interesting portion of the book is undoubtedly that connected with the behaviour of storms, and the formation of weather charts with a view to weather prediction. Here the catechist has practically to stand aside. In about twenty pages we meet with only eighteen distinct questions, and the tale is therefore practically told without that annoying form of interruption. And it is very well told. We feel that the author has shaken himself free from his self-imposed fetters, and is doing himself justice, and we can only regret that the earlier portion of the work is not marked by a similar freedom.

OUR BOOK SHELF.

The New Technical Educator: an Encyclopædia of Technical Education. Vol. I. (London, Paris, and Melbourne: Cassell and Co., Limited, 1893.)

THE subjects dealt with in vol. i. are as follows:—Drawing for Carpenters and Joiners, Cotton Spinning, Cutting Tools, Dyeing of Textile Fabrics, Electrical Engineering, Drawing for Engineers, Photography, Plumbing, Practical Mechanics, Projection, The Steam Engine, Steel and Iron, Technical Education, Watch and Clock Making, and Woollen and Worsted Spinning.

Taken as a whole, all these subjects are well written and illustrated copiously, several full-page plates being given. The frontispiece is coloured, and represents the scene in the Bessemer department of a steel works at night, during the process of a "blow." A very good idea is given of the wonderful pyrotechnic display.

The steam-engine is treated very much from the "heat" point of view.

Under the head of Plumbing much useful information is to be found, particularly the making of joints and bends in pipes of lead and other metals. It is usual, when making a bend in a wrought-iron lap-welded pipe, to endeavour to keep the weld on the inside of the bend, when possible, for obvious reasons. This is purely a practice which every gasfitter or plumber would naturally follow, and its omission from the paragraph is to be regretted.

The articles on electrical engineering are excellent as far as they go. The illustrations are clear and to the point; one or two of the earlier ones, however, would be improved by the addition of the lines of force.

Prof. R. H. Smith takes charge of the articles on "Cutting Tools"; needless to say they are well written, with examples taken from every-day practice in the works. The introduction of milling machinery into the engineering works of the country is comparatively of recent date, yet this method of machining work is rapidly coming to the front, and milling machinery is taking the place of the planing, slotting, and shaping machine for duplicate and general work. One great drawback to this method of working is the cost of the milling cutters; these are very expensive to make, and sometimes during the process of hardening and tempering they very often crack in the body or some of the teeth fly off. On the other hand, the quality of the work done by the milling machine is better than that from an average planing machine, less hand labour being required to finish the work.

The articles on technical education are most instructive; they cover a good deal of ground, generally taking a sensible and moderate view of the question. In the first article on this subject, the author, Mr. Henry Cunyngham, says that the object of technical education is to make good industrial workmen, and then goes on to name what are the qualities which go to make up a good

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